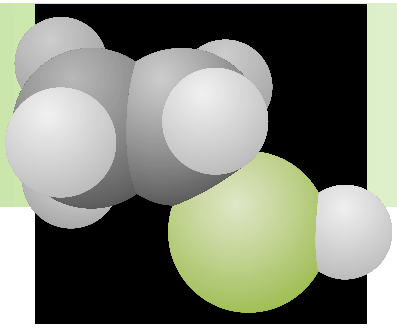
CHEMICALS

Project Fact Sheet



CATALYST FOR CH_4-CO CONVERSION

BENEFITS

- Global economic benefits
- More efficient utilization of domestic and remote gas resources
- Decreased oil importation expenditures

APPLICATIONS

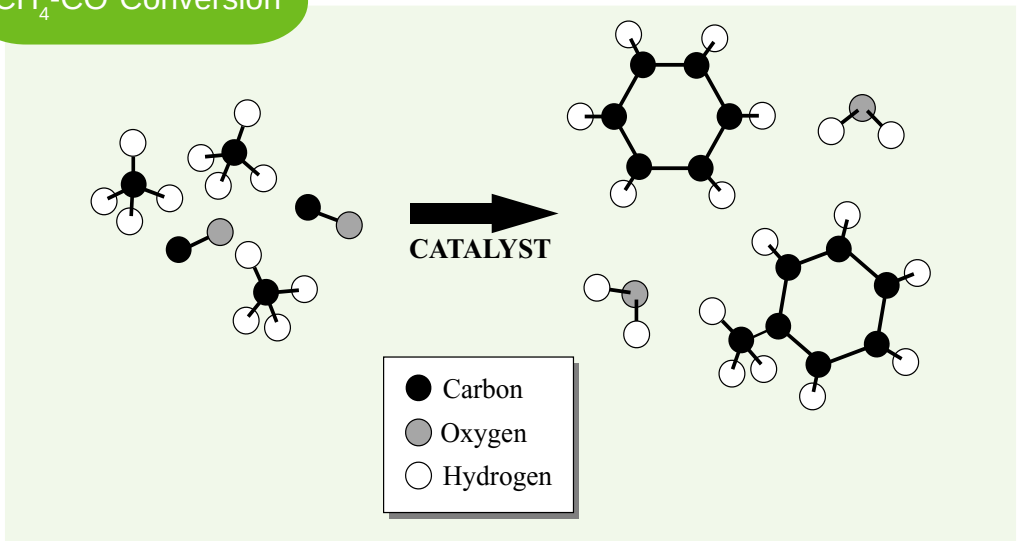
This technology is designed for the direct conversion of natural gas to liquid petrochemicals and intermediates. Considering that mature markets exist for aromatics and their respective derivatives, industry-wide acceptance, endorsement, and commercial implementation of the process is expected.

NEW TECHNOLOGY ALLOWS FOR NATURAL GAS TO BE DIRECTLY CONVERTED TO LIQUID CHEMICALS

High cost and inefficient processes have limited the feasibility of large-scale production of liquid chemicals from the U.S. domestic coal and natural gas supply. Current gas-to-liquid transformation involves an indirect route in which natural gas is first converted to synthesis gas and subsequently converted to liquids by available technologies such as the Fisher-Tropsch process. Up to 60 percent of the cost of this process is associated with the intermediate production and purification of synthesis gas. Consequently, there is considerable interest in the development of new, economical catalyst and process technologies that directly convert natural gas to liquids.

Project partners will develop a catalyst that allows for the direct conversion of methane to aromatics (benzene, toluene, xylene, and naphthalene) and light olefins. Earlier projects exploring the direct conversion of methane to aromatics were economically nonviable due to low methane conversion and poor selectivity. This process addresses these concerns. It is suitable for fixed bed reactor technology and is capable of being quickly scaled-up to commercial capacity. Successful completion of this project will provide a significant increase in the utilization of domestic and remote natural gas reserves because it directly converts natural gas to higher molecular weight products of substantially higher market value.

CH_4-CO Conversion



The diagram shows the process for the direct conversion of CH_4 and CO to aromatics and olefins.

Project Description

Goal: The goal of this project is to develop a novel catalyst and process for the direct conversion of methane and carbon monoxide to aromatics and light olefins.

Conventional CH_4 dehydro-aromatization involves the direct conversion of CH_4 to benzene, ethylene and napthalene. The process suffers from low CH_4 conversion, poor selectivity, and thermodynamic constraints, which neccesitate operation at low CH_4 partial pressures and temperatures exceeding 973 K. Project partners are developing a multi-functional catalyst and process that overcomes the inherent limitations of CH_4 dehydro-aromatization and permits the direct conversion of CH_4 to aromatics and olefins at temperatures below 973 K and at pressures significantly above 1 atmosphere.

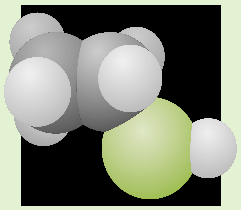
Progress and Milestones

Significant progress has been made in the following areas:

- Demonstrated that a multi-functional catalyst can be prepared and activated for simultaneous CH_4-CO conversion.
- Demonstrated that at least one catalyst composition exits such that CH_4 conversion and hydrocarbon selectivity for simultaneous CH_4-CO conversion are better than those demonstrated for pure CH_4 dehydro-aromatization.
- Demonstrated that the multi-functional catalyst permits operation at reaction temperatures lower than 973 K and pressures significantly higher than 1 atm.

Future research focuses on achieving the following milestones:

- Increase the product selectivity of benzene, toluene, and xylene to 75 weight percent on a hydrocarbon basis at a CH_4 conversion of 25 percent.
- Demonstrate stable and continuous performance of the process for one week.



Project Partners

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